

A catalyst comprising Pt-Co alloy, or Pt-Co-Sn alloy or Pt-Co<sub>m</sub>O<sub>n</sub> mixed metal oxides is disclosed to be used as a catalyst for the direct electrochemical oxidation of glucose or other simple sugars and carbohydrates at room temperature. The catalyst can be supported on metal electrodes, graphite electrodes, porous carbon electrodes, or gas diffusion electrodes. An electrode containing this catalyst will be used as the key component in a direct glucose-air fuel cell operating in alkaline media with a good room temperature performance. This catalyst can also be applied as a key electrode material in a glucose sensor to detect glucose concentration in neutral or alkaline medium. The preparation method of the catalyst, optimum composition, and results of glucose sensor and glucose fuel cell applications are disclosed.